



**THE DATASHEET OF
ICS650G-40ALF**



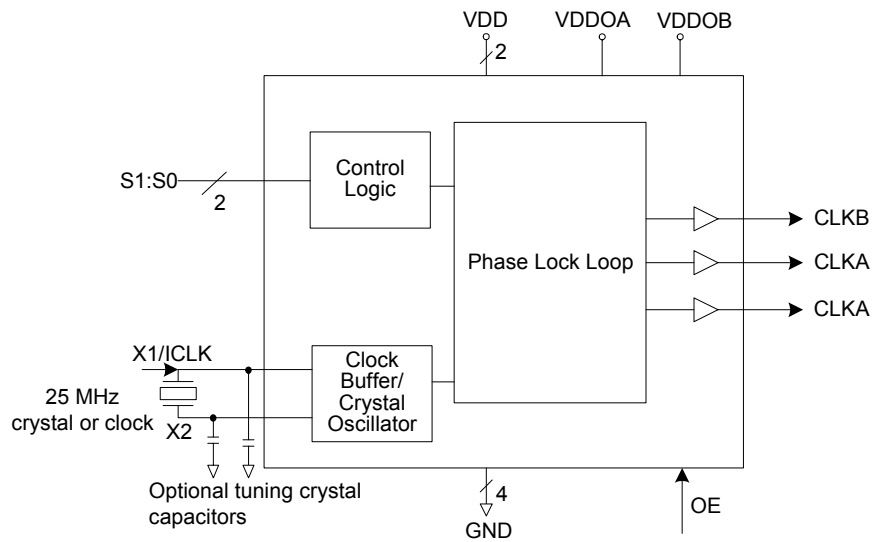
Description

The ICS650-40A is a clock chip designed for use as a core clock in Ethernet Switch applications. Using IDT's patented Phase-Locked Loop (PLL) techniques, the device takes a 25 MHz crystal input and produces various output clock frequencies as listed in Output Select Table.

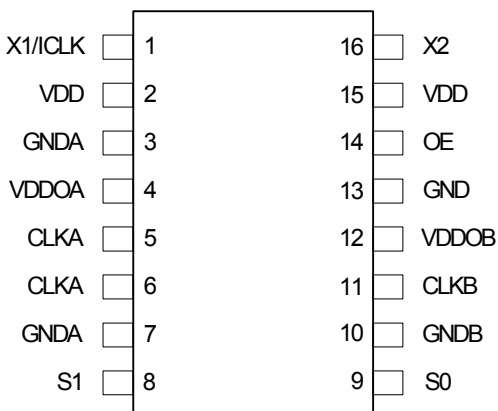
Features

- Packaged in 16-pin TSSOP
- Operating voltage of 3.3 V
- Low power consumption
- Input frequency of 25 MHz
- Low long-term jitter
- Separate supply voltage for clock outputs (2.5 / 3.3 V clock outputs)
- OE control capability

Block Diagram



Pin Assignment



16-pin (173 mil) TSSOP

Output Select Table (MHz)

| S1 | S0 | CLKA (MHz) | CLKA (MHz) | CLKB (MHz) |
|----|----|------------|------------|------------|
| 0 | 0 | 127 | 127 | 157 |
| 0 | 1 | 133 | 133 | 189 |
| 1 | 0 | 157 | 157 | 127 |
| 1 | 1 | 189 | 189 | 133 |

Pin Descriptions

| Pin Number | Pin Name | Pin Type | Pin Description |
|------------|----------|----------|--|
| 1 | X1/CLK | Input | Crystal or clock input. Connect to a 25 MHz crystal or single ended clock. |
| 2 | VDD | Power | Connect to +3.3 V. |
| 3 | GNDA | Power | Connect to ground. |
| 4 | VDDOA | Power | Connect to +2.5 V or +3.3 V. For CLKA outputs only. |
| 5 | CLKA | Output | Clock A output with weak pull-down resistor. |
| 6 | CLKA | Output | Clock A output with weak pull-down resistor. |
| 7 | GNDA | Power | Connect to ground. |
| 8 | S1 | Input | Select pin 1. |
| 9 | S0 | Input | Select pin 0. |
| 10 | GNDB | Power | Connect to ground. |
| 11 | CLKB | Output | Clock B output with weak pull-down resistor. |
| 12 | VDDOB | Power | Connect to +2.5 V or 3.3 V. For clock output B only. |
| 13 | GND | Power | Connect to ground. |
| 14 | OE | Input | Output enable tri-states outputs and device is not shut down. This input has internal pull-up resistor. OE = 1 enables outputs A and B and OE=0 disables outputs A and B. When disabled the pull-down resistor pulls the outputs to GND. |
| 15 | VDD | Power | Connect to +3.3 V. |
| 16 | X2 | Output | Crystal connection. Leave unconnected for clock input. |

External Components

A minimum number of external components are required for proper operation. Decoupling capacitors of 0.01 μF should be connected between VDD and GND pairs. The capacitors should be placed between pins VDD and GND, VDDOA and GND, and VDDOB and GND as close to the device as possible. A 33 Ω series terminating resistor should be used on each clock output if the trace is longer than 1 inch. A 25 MHz fundamental mode parallel resonant crystal should be used with $C_L=18$ pF.

On chip capacitors. On Chip capacitors are used for a 18 pF load crystal. Small, 2-3 pF trimming capacitors are used from pins X1 to ground and X2 to ground to optimize the initial accuracy.

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the ICS650-40A. These ratings, which are standard values for IDT commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.

| Item | Rating |
|-------------------------------|---------------------|
| Supply Voltage, VDD | 7 V |
| All Inputs and Outputs | -0.5 V to VDD+0.5 V |
| Ambient Operating Temperature | 0 to +70° C |
| Storage Temperature | -65 to +150° C |
| Junction Temperature | 125° C |
| Soldering Temperature | 260° C |

Recommended Operation Conditions

| Parameter | Min. | Typ. | Max. | Units |
|---|-------|------|-------|-------|
| Ambient Operating Temperature | 0 | | +70 | °C |
| Power Supply Voltage (measured in respect to GND) | +3.15 | | +3.45 | V |

DC Electrical Characteristics

VDD=3.3 V ±5%, VDDOA = VDDOB= 3.3 V ±5% Ambient Temperature 0 to +70° C

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|--|-----------------|---|-----------|------|-----------|-------|
| Operating Voltage | VDD | | 3.15 | | 3.45 | V |
| Output Operating Voltage | VDDOA, B | | 2.375 | | 3.45 | V |
| Input High Voltage, ICLK | V _{IH} | Note 1 | VDD/2+0.5 | | | V |
| Input Low Voltage, ICLK | V _{IL} | Note 1 | | | VDD/2-0.5 | V |
| Input High Voltage, S1:S0:OE | V _{IH} | | 2 | | VDD | V |
| Input Low Voltage, S1:S0:OE | V _{IL} | | | | 0.8 | V |
| Output High Voltage | V _{OH} | I _{OH} = -12 mA, 3.3 V VDDO | 2.0 | | | V |
| Output Low Voltage | V _{OL} | I _{OL} = 12 mA, 3.3 V VDDO | | | 0.4 | V |
| Operating Supply Current | IDD | No load | | 40 | | mA |
| IDD at Output Disable Condition(OE low) | | No load | | 16 | | mA |
| Short Circuit Current | I _{OS} | Each output | | ±70 | | mA |
| Internal Pull-up Resistor | R _{PU} | OE pin | | 300 | | kΩ |
| Internal Pull-down Resistor | R _{PD} | CLK outputs | | 300 | | kΩ |

Note: 1. Nominal switching threshold is VDD/2.

AC Electrical Characteristics

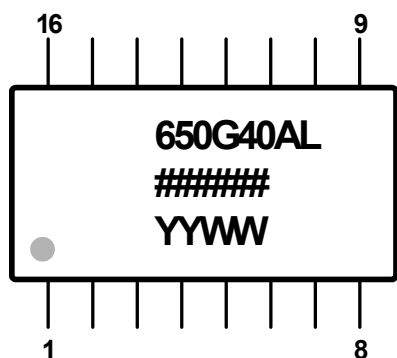
VDD=3.3 V ±5%, VDDOA = VDDOB = 3.3 V ±5%, C_L=10 pF Ambient Temperature 0 to +70° C

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|--|-----------------|---------------------|------|-------|------|-------|
| Input Frequency | | | | 25 | | MHz |
| Output Rise Time | t _{OR} | 20% to 80% of VDD | | 0.6 | | ns |
| Output Fall Time | t _{OF} | 80% to 20% of VDD | | 0.6 | | ns |
| Output Clock Duty Cycle | | At VDD/2 | 40 | 49-51 | 60 | % |
| Frequency Error | | All clocks | | 0 | | ppm |
| Output to Output Skew between clocks of the same frequency | | | | | 250 | ps |
| Absolute Jitter, Short-term P-P | | Variation from mean | | ±120 | | ps |
| Absolute Jitter, Short-term C-C | | Variation from mean | | ±120 | | ps |
| Long-term Jitter | | 1000 clock cycles | | 600 | | ps |

Thermal Characteristics

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|--|---------------|----------------|------|------|------|-------|
| Thermal Resistance Junction to Ambient | θ_{JA} | Still air | | 78 | | °C/W |
| | θ_{JA} | 1 m/s air flow | | 70 | | °C/W |
| | θ_{JA} | 3 m/s air flow | | 68 | | °C/W |
| Thermal Resistance Junction to Case | θ_{JC} | | | 37 | | °C/W |

Marking Diagram (RoHS compliant)

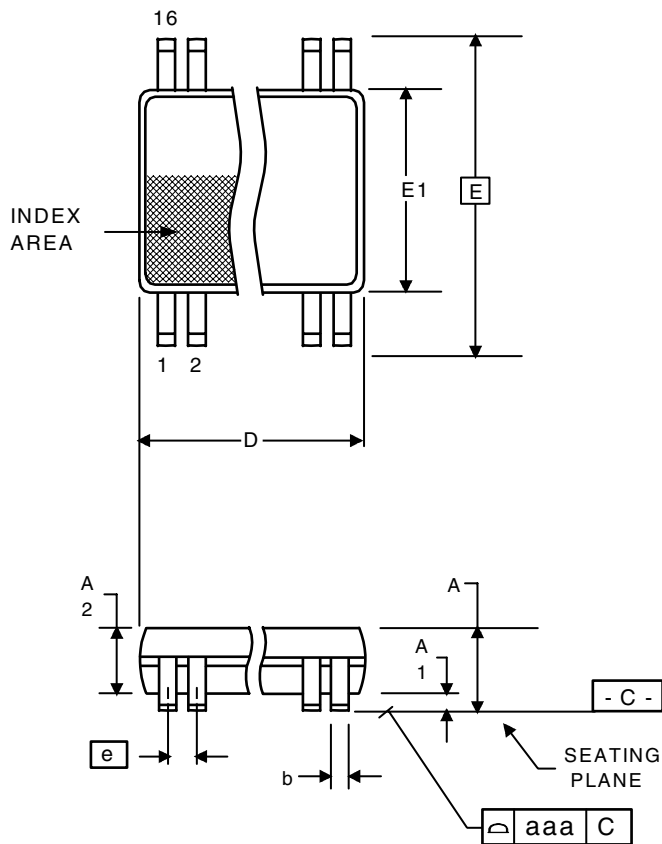


Notes:

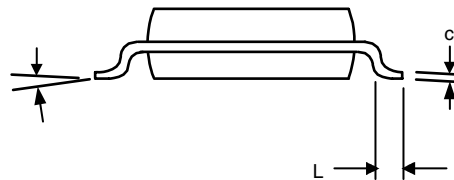
1. ##### is the lot code.
2. YYWW is the last two digits of the year, and the week number that the part was assembled.
3. "L" designates RoHS compliant package.
4. Bottom marking: country of origin if not USA.

Package Outline and Package Dimensions (16-pin TSSOP, 173 Mil. Narrow Body)

Package dimensions are kept current with JEDEC Publication No. 95



| Symbol | Millimeters | | Inches | |
|----------|-------------|------|--------------|-------|
| | Min | Max | Min | Max |
| A | -- | 1.20 | -- | 0.047 |
| A1 | 0.05 | 0.15 | 0.002 | 0.006 |
| A2 | 0.80 | 1.05 | 0.032 | 0.041 |
| b | 0.19 | 0.30 | 0.007 | 0.012 |
| C | 0.09 | 0.20 | 0.0035 | 0.008 |
| D | 4.90 | 5.1 | 0.193 | 0.201 |
| E | 6.40 BASIC | | 0.252 BASIC | |
| E1 | 4.30 | 4.50 | 0.169 | 0.177 |
| e | 0.65 Basic | | 0.0256 Basic | |
| L | 0.45 | 0.75 | 0.018 | 0.030 |
| α | 0° | 8° | 0° | 8° |
| aaa | -- | 0.10 | -- | 0.004 |



Ordering Information

| Part / Order Number | Marking | Shipping Packaging | Package | Temperature |
|---------------------|------------|--------------------|--------------|-------------|
| 650G-40ALF | See Page 6 | Tubes | 16-pin TSSOP | 0 to +70° C |
| 650G-40ALFT | | Tape and Reel | 16-pin TSSOP | 0 to +70° C |

"LF" suffix to the part number are the Pb-Free configuration and are RoHS compliant.

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ICS650-40A

ETHERNET SWITCH CLOCK SOURCE

CLOCK SYNTHESIZER

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